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V.—*On Antarctic Discovery and its connection with the Transit of Venus in 1882.** By J. E. DAVIS, Staff-Commander R.N., F.R.G.S.

Read, February 22, 1869.

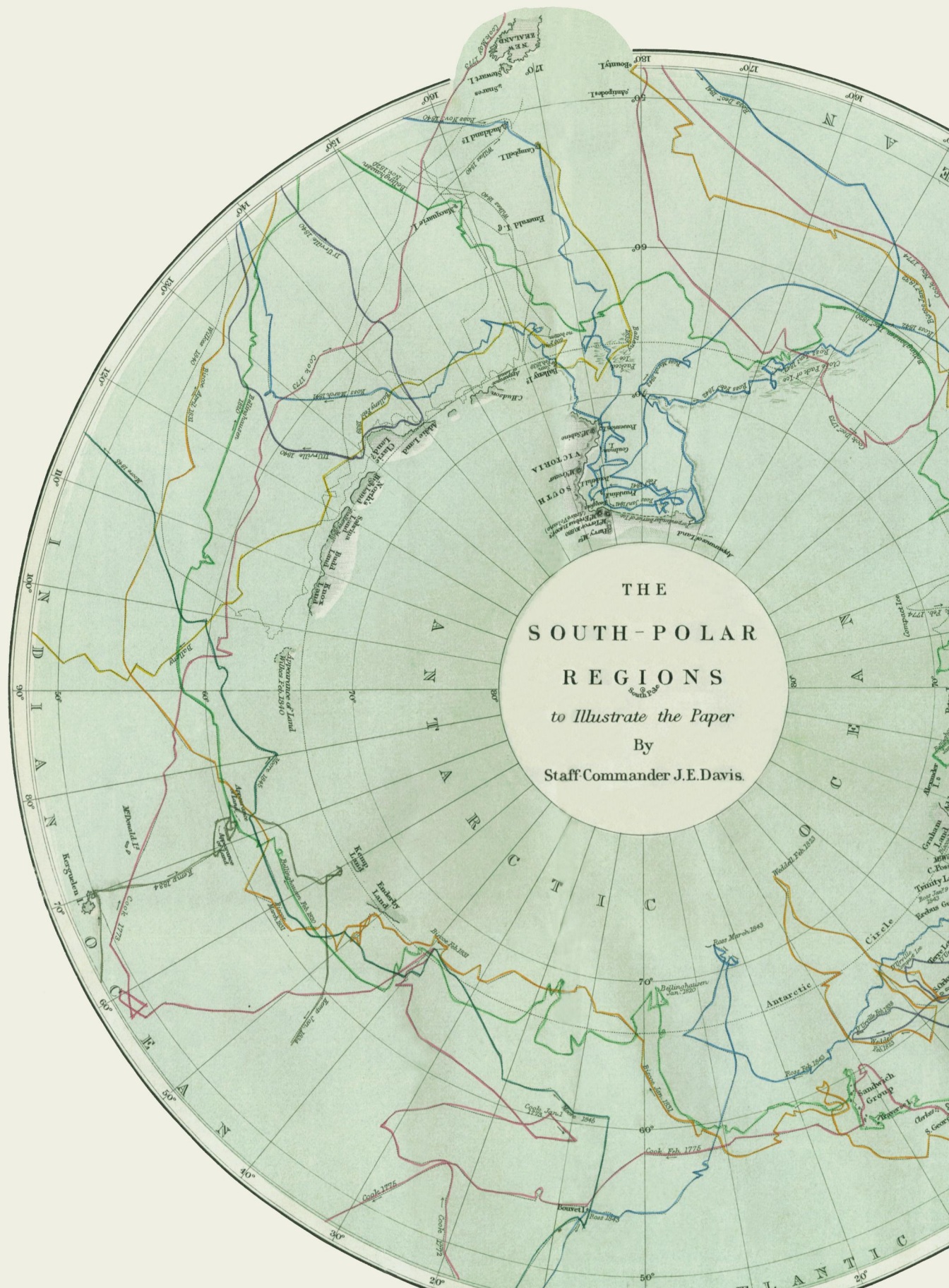
I NEED scarcely remark that the object to be gained by observing the transit of Venus over the sun's disk is the ascertainment, to be deduced therefrom, of the distance of the sun from the earth, the sun being at present three or four millions of miles out of her (or our) reckoning, the calculations at present differing to that extent. The most simple mode of explaining the process by which this is accomplished, is by stating that all that is required for the calculation is the exact angle subtended by the radius of the earth from the sun, and as we cannot get to the sun to measure that angle, it must of necessity be done from the earth, and that by means of parallax, or the apparent change in the position of the sun by a change of position on either side of the earth's centre, and as the amount of the sun's parallax in dispute (causing this three to four millions of miles error) is but little more than the third of a second of arc, it may be imagined (or to the uninitiated it cannot be imagined) what figures and quantities have to be dealt with.

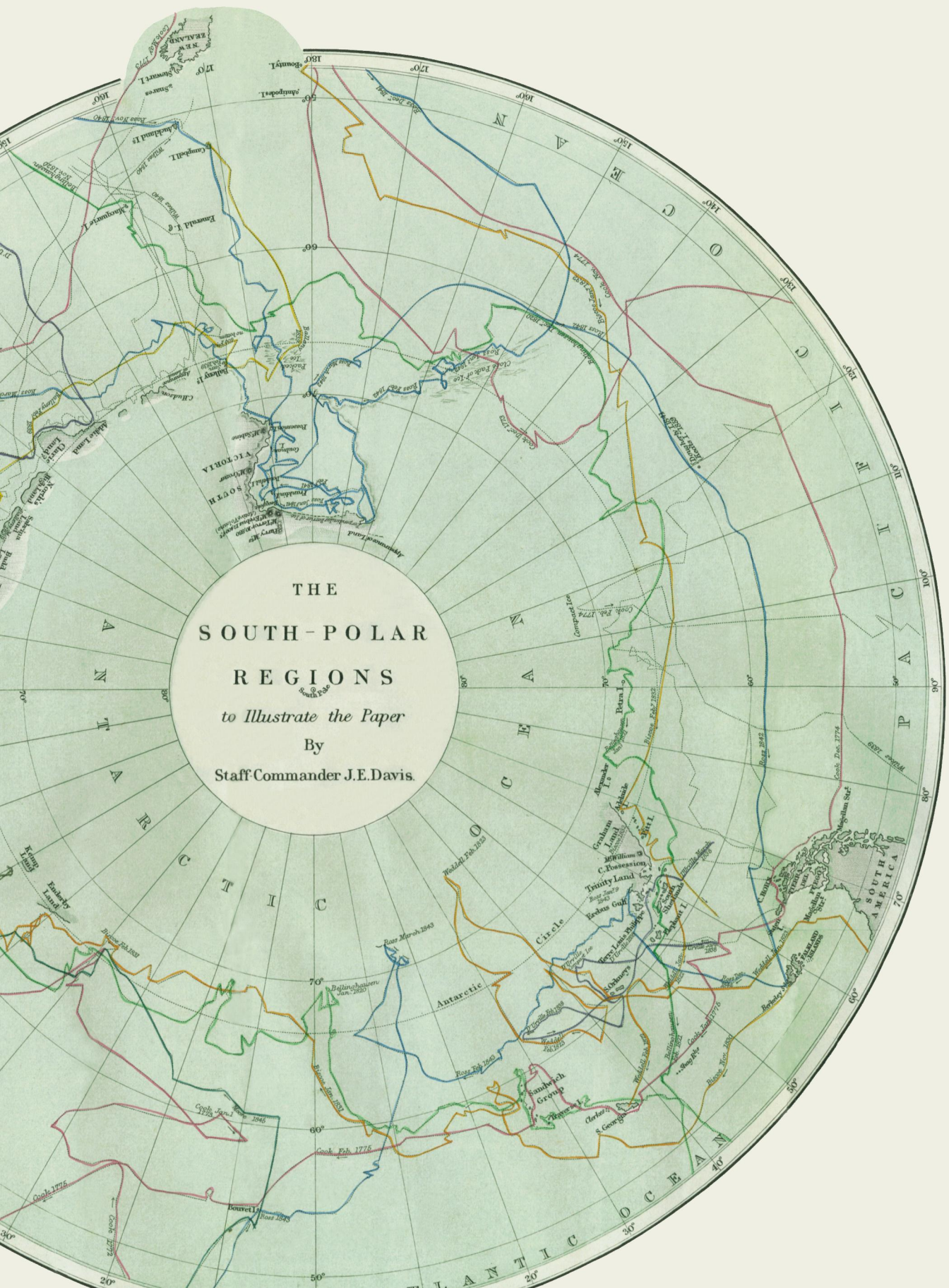
There are other methods by which the sun's distance may be ascertained; but astronomers assure us that the best is that by the transit of Venus across the sun's disk, observed from widely different and opposite parts of the globe, at the moment of the ingress and egress, and as these transits occur only at intervals of 100 years (when two take place in 8 years), it is necessary, *if* they are to be observed, to "make hay while the sun shines." One occurred in 1761, and the last in 1769; the next will take place in 1874, and the one in connection with my subject in 1882.

It is very easy to understand that if the ingress or egress of the planet be observed from points of the meridian on either side of the centre of the illuminated portion of the earth, the moment of contact will be accelerated in the one case and retarded in the other; and that this acceleration and retardation would increase in ratio to the distances of the points of observation, being greatest at spots most divergent from the centre of the illuminated arc, or where the sun is on the horizon; but as it is not possible to observe the transit from those positions,

* The first part of this paper consisted of a careful *resumé* of the voyages and discoveries in the South Polar regions, from that of Dirk Gerritz in 1599 to those memorable ones of Sir James Clark Ross in 1839-43, in which the Author took a part. The result of this *resumé* is embodied in the accompanying map.

Staff-Commander J.E.Davis.



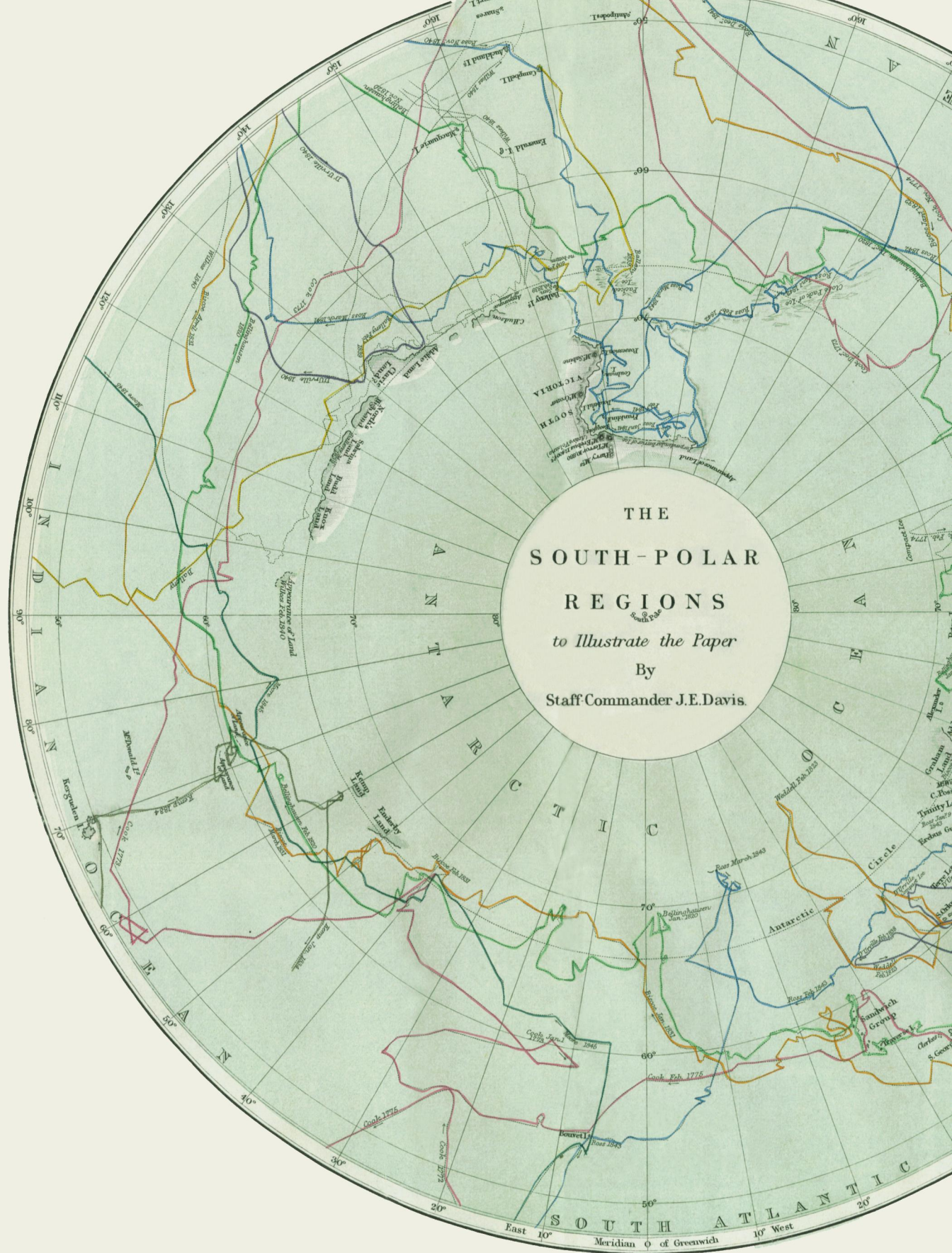


THE
SOUTH-POLAR
REGIONS

to Illustrate the Paper

By

Staff Commander J.E.Davis.



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one as near to it as possible must be obtained. Thus, in the diagrams,* the lower line represents the extreme sides, with the sun on the horizon, at which the acceleration and retardation are greatest, and the semicircles the decrease towards the centre, each tenth or factor being equidistant, treating the earth as a plane instead of a sphere. The dotted lines are the parallels of latitude and the hourly meridians of longitude.

There are two methods by which this transit can be effectually observed:—1st. By absolute longitudes from four stations, viz., one for acceleration by parallax, and one for retardation for the ingress, and the same for the egress; for, as the planet takes about six hours to cross the sun's disk, there are but few places from which both the ingress and egress can be observed (having due consideration for parallactic value), and it is when this is the case that this method is applicable, and for which accurate determinations of longitude are necessary; an error of *one* second in time would vitiate the result.

The other method is by observing both ingress and egress from two stations—one for acceleration by parallax, the other for retardation; and the great advantage of this method over the other being that the accurate determination of longitude is not an absolute necessity. In the transit of Venus in 1882 one such station is to be found in the North American colonies, and the other can only be obtained in a high southern latitude, to which this paper refers. In the diagrams the horizontal lines denote the elevation or altitude of the sun and the semicircles the relative value of a station parallactically, and this value is denoted by factors, of which 1.0 represents the point of greatest value, and the decimals the lessening value—the highest altitude of the sun and the highest factor being the best position for observing the transit. Thus the normal point is useless, the sun being on the horizon, and at Cape Town the parallactic value is too small. At Kerguelen's Island the altitude of the sun at the ingress will be about 12° , while the parallactic value is large (about 0.97), at Crozet's, altitude 24° , parallactic value 0.9, both very good stations, but another element has to be considered, viz., Meteorology; and these stations with those in other localities, as the Mauritius and islands near, are only adapted for the first method, and dependent on absolute longitude, but if a suitable position can be found on the high southern land, the second method can be adopted; and for this purpose the Astronomer Royal has suggested two points—one near Sabrina Land, in 7 hours East longitude, where the ingress and egress could be observed on either side of the nether pole, at an altitude

* These diagrams were kindly furnished by the Astronomer Royal.

TRANSIT OF VENUS, 1882, DEC^r 6.

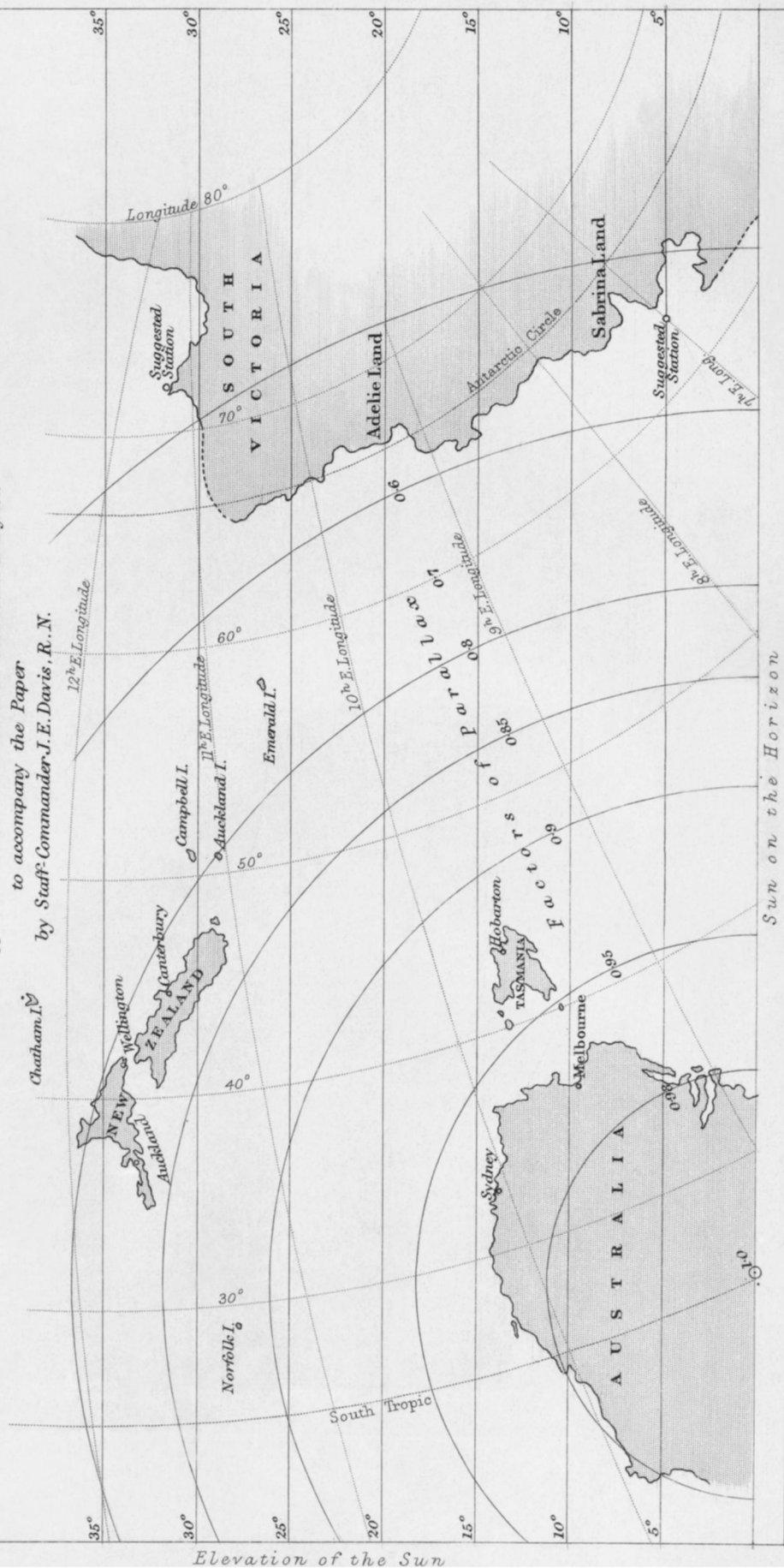
Stations for observation of the Egress of Venus.

The Sun ascending, Venus leaving the Upper Limb. Egress retarded by Parallax.

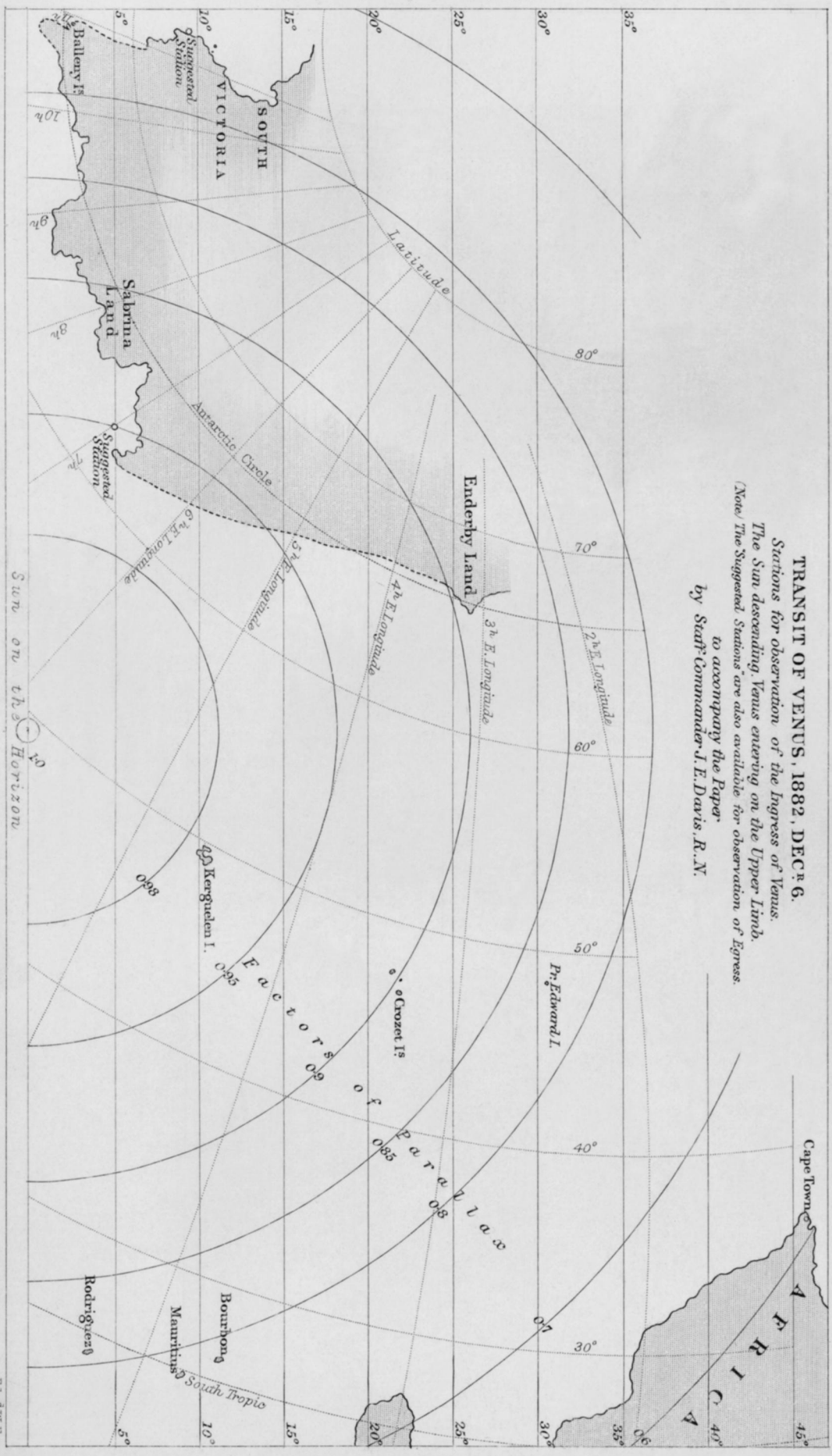
(Now) The Suggested Stations are also available for observation of Ingress.

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by Staff-Commander J.E. Davis, R.N.



TRANSIT OF VENUS, 1882, DEC^r 6.
 Stations for observation of the Ingress of Venus.
 The Sun descending, Venus entering on the Upper Limb.
 (Note: The Suggested Stations are also available for observation of Egress.
 to accompany the Paper
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of about 5° , the other on the coast of South Victoria, in latitude 72° , or in a higher latitude if possible. The first position is not a promising one, as the high land would be immediately between the observer and the sun, and with an altitude of less than 5° it is not probable the sun would be seen above the mountains.

The other suggested position affords a better prospect of success; still there is one difficulty in connection with that, viz., the utter impracticability of reaching it in time to make the observation: the 6th of December would be a month too early, and, as time would be requisite to arrange and adjust the instruments, it would be necessary to be on the spot at least a month earlier than that date. This difficulty is not insurmountable, and can be overcome by landing the party the previous summer in January. This necessity would prove beneficial to science, as advantage would be taken of the opportunity to obtain a series of observations in meteorology and other branches, through an antarctic winter.

The *modus operandi* I would suggest is, that two vessels with steam-power should leave England about June, 1881, having on board the equipment, in men and instruments, for observing the transit by both methods. On the passage out the parties for the first method, with their instruments, should be landed on the selected stations, and at once commence moon observations for the determination of the longitude, while the vessels proceeded to Hobarton, from which place, in the latter end of December, they would proceed south in longitude about 165° east, and keeping well to the westward, endeavour to make Balleny islands, take the pack and work through it towards South Victoria, and then skirt the coast along as closely as possible; for although Sir James Ross did not observe the appearance of a harbour, it is just possible a different season may open one up. Proceeding south past Possession island, a careful examination of Coulman island, in latitude $73\frac{3}{4}^{\circ}$, should be made, and failing to find a harbour or suitable position for landing on that island, to return at once to Possession island (where Sir James Ross effected a landing) and land the party with huts, instruments, and provisions, for two years, the ships returning north, and, after visiting the other observing parties and supplying their wants, again proceed south, about the same time as the previous year, and after embarking the southern party, return and pick up the others, and return to England.

With regard to the meteorological element alluded to, it is decidedly in favour of the high southern position. All polar voyagers agree in stating that there is but little medium weather in high latitudes; it is either very bad or very delightful, and

pretty evenly balanced. When fine, it is the perfection of fine weather, with an atmosphere so clear that mountains 80 or 100 miles distant would readily be believed to be not more than 20. On the contrary, when the weather is bad, it is very bad, and nothing to be seen; so that the chances of obtaining the observation, or not, are about equal.—Not so at Kerguelen or Crozet islands: such navigators as have passed them have generally found them wrapped in a mantle of mist, and although it is scarcely fair to draw conclusions from a winter residence, still between two and three months' sojourn at Kerguelen's, have left vivid recollections of the humidity of the atmosphere and the variableness of the climate.

Of the value to be attached to the observation of this transit, astronomers can best testify; and the testimony of the illustrious Halley, as quoted by the Astronomer Royal, is thus rendered from the Latin:—

“And heartily could I wish observations of this phenomenon to be made by several in divers localities (as much for the establishment of a firmer belief through a general agreement, as lest a single observer should be frustrated by intervening clouds) of such a spectacle as I know not that men of this or the following age will again see, and upon which depends the certain and satisfactory solution of a most remarkable and otherwise insolvable problem. And to such subtle examiners of the heavenly bodies, after our decease, are these *observanda* committed. Again and again do we commend to them that, encouraged by the memory of this work of ours, they should strenuously, even with their whole powers, apply themselves to the thorough fulfilment of the observation, and for them we devoutly pray and wish all propitious circumstances; above all, that they may not be deprived of their most anxiously desired view by an inopportune obscuration from a clouded sky, and that, finally, the discovery of the magnitudes comprised within the narrower limits may redound to their lasting honour and glory.”

If this great national work, of which we are to be so proud—this remarkable and otherwise insolvable problem—is to be accomplished, those that are to be instrumental in its accomplishment must go to school at once, and *that school* is the *North*. Sir James Ross, without his previous experience obtained in the north, would not have been so successful in the south. In 1881 we shall no doubt, as now, have plenty of good men and true ready and willing to go; but it is no reflection on them to say that, without previous experience in ice-navigation, the voyage would prove a failure; and now that North Polar research is revived, and foreigners are straining every nerve to reach the pole (a gallant Swede has taken his

ship to a higher latitude than any ship has previously been—treading on the very heels of Parry—and an American has trod on more northern land), is England not to make an effort to hold her own? It is to be hoped that we shall soon see an expedition afoot—whether to Smith Sound or the Spitzbergen Strait it matters not, although, for the educational purpose alluded to, the latter is the best. Shame will be on us if a foreigner should step in and carry off our Polar honours; that even in this utilitarian age we shall find some men in power who do not consider it money thrown away to advance geographical knowledge and add to scientific research, and who will advocate the cause of Polar discovery and enable us to keep up our breed of Polar men, who add so much to the peaceful honours of our country.

That this great problem of the age may be solved, and that by Englishmen, is the heartfelt wish of every astronomer and geographer; and indeed every true Englishman would well be proud of a success which would redound so much to the honour of his country.

VI.—*On the Basin of Colorado and the Great Basin of North America.* By W. A. BELL, M.A., M.B.

Read, March 8, 1868.

IN the spring of 1867 a very extensive surveying expedition was organised by the Kansas Pacific Railway Company of North America, in order to determine upon the best route for a Southern Railway to the Pacific coast through Kansas, Colorado, New Mexico, Arizona, and the southern part of California.

Until the Rio Grande (about equi-distant from the Mississippi and the Pacific) had been reached, three separate surveying parties only were required, but *west* of that river, across the regions of which the present paper treats, no less than five distinct parties, each capable of making an accurate instrumental survey for a railway, crossed the continent by different routes, on different parallels of latitude.

As my office in the expedition did not necessitate my taking any part in the surveys, or remaining permanently attached to any one party, I was enabled to travel over much of the country lying between the 33rd and 31st parallels of latitude in New Mexico and Arizona, and to recross the Great Basin and the Rio Colorado Basin, a second time about the 41st parallel. Others of our parties examined the country lying between the 34th and 35th parallels, and the information obtained from them,